Star's Name.	R.A. 1900. h m	N.P.D. 1900. ° ′	Position Angle. °	Distance. ″	No. of Nights.	Mags.	Epoch 1899.	Obs.
β 720 ...	23 29	59 14	157·4	0·33	3	5·5 5·5	·779	W.B.
			163·9	0·31	1	...	·780	B.
			162·1	0·38	3	...	·813	L.
β 858 ...	23 36	58 0	267·7	0·58	1	8·0 8·2	·780	B.
			260·1	0·52	2	...	·831	L.
A.G.C. 14 ...	23 39	61 12	194·3	1·23	1	5·5 9·7	·780	B.
			196·9	1·28	1	...	·830	W.B.
			196·9	1·25	2	...	·834	L.
Σ 3037 ...	23 41	30 5	213·7	2·67	1	7·0 8·5	·068	B.
Barnard ...	23 42	85 18	166·8	0·62	1	8·6 8·6	·737	B.
Σ 3047 ...	23 54	33 10	72·5	1·26	1	8·7 8·7	·068	B.
Σ 3050 ...	23 54	56 51	214·3	2·37	1	6·0 6·0	·797	W.B.
			214·3	2·40	1	...	·832	L.
Σ 3056 ...	23 59	56 20	153·7	0·40	1	7 8	·893	L.

Measures of Double Stars from Photographs taken at the Royal Observatory, Greenwich.

(Communicated by the Astronomer Royal.)

The photographs were taken with the 26-inch refractor of the Thompson Equatorial, the stars photographed being either bright stars with faint companions, or selected double stars which seemed well suited for photographic measurement. For the former an occulting shutter, carried by an arm pivoted in the side of the dark slide, was used to screen the bright star, a series of short intermittent exposures for it being given during the long exposure required for the companion by raising the arm of the shutter by hand and allowing it to fall back into position again as rapidly as practicable. In order to allow of still shorter exposures in the case of very bright objects a useful modification was introduced by Mr. Davidson. In the new arrangement the shutter consists of two parts separated by a narrow slit, so that the exposure is given only during the rapid passage of the slit across the star's image, and by this device it is found practicable to give exposures of about $0^{s}\cdot01$ only in duration.

The exposures given to the photographs were, as far as possible, such as would give small and sharp images; for bright pairs dry collodion plates were sometimes used, but for stars with faint companions Ilford special rapid plates were used. A second exposure was given for orientation, the clock being put out of

gear for about 10^s, and sometimes two subsidiary exposures of this kind were given as a check.

The photographs were measured in a position-micrometer by two measurers, being measured by each in reversed positions of the plates to eliminate personality.

Details are given in the case of *β Persei*, *Aldebaran*, and *ξ Ursæ Majoris* to indicate the accuracy obtainable in double star observations from photographs. The main part of the discordances appears to be due to the photographic images themselves and not to error of measurement. Much higher accuracy is obtainable with stars such as *ξ Ursæ Majoris*, *γ Virginis*, &c., than with stars like *Aldebaran*, where the companion is very faint.

β Persei.—These results are obtained from three photographs taken on October 11, October 17, and November 10. On October 11 and October 17 exposures of 20^m were given to the faint companions, and a single exposure of about $\frac{1}{2}^s$ to *Algol*. On November 10, twenty short exposures were given to *Algol* of about $\frac{1}{100}^s$ each at intervals of 1^m during the 20^m exposure on the field, Mr. Davidson's new arrangement of the occulting shutter being used. The sums of the projections of the sides of the two closed triangles ABC and ADE revolved in the directions 0° and 90° are $-0''.02$, $-0''.05$ for ABC, and $+0''.02$, $+0''.09$ for ADE, which furnish a sufficient test of the accuracy of the measures.

Aldebaran.—The first set of results is obtained from photographs taken on 1899 February 24, March 9, March 14, and March 15. On two of these photographs a single short exposure was given to the primary, and an exposure of 20^m to the companions. On the other two five short exposures were given to the primary.

The second set of results depends on four photographs taken 1899 November 10, 1900 January 18, January 24, and February 9. These were taken with the occulting shutter after its alteration, and at each minute of the 20^m exposure of the faint stars a short exposure (estimated from the size of the image at $\frac{1}{100}^s$) was given to *Aldebaran*, which thus had a total exposure of about $\frac{1}{5}^s$. The following individual results for A and B are given as showing the accuracy attained in these photographs :—

Date.	Measurer.	Angle.	Discordance from Mean.	Distance.	Discordance from Mean.
1899 Nov. 10	C.D.	109°.84	+0°.10	31″.73	+0″.16
„	P.M.	109.42	−0.32	31.79	+0.22
1900 Jan. 18	C.D.	109.45	−0.29	31.35	−0.22
„	P.M.	109.82	+0.08	31.23	−0.34
Jan. 24	C.D.	109.97	+0.23	31.54	−0.03
„	P.M.	110.25	+0.51	31.60	+0.03
Feb. 9	C.D.	109.95	+0.21	31.65	+0.08
„	P.M.	109.25	−0.49	31.65	+0.08

ξ Ursæ Majoris.—The separate observations of this star are as follows :—

Date.	Measurer.	Angle.	Discordance from Mean.	Distance.	Discordance from Mean.
		°	°	″	″
1899 Apr. 11	C.D.	159·39	+2·4	1·89	−0·04
„	P.M.	162·03	+5·1	1·95	+0·02
Apr. 17	C.D.	156·35	−0·6	1·95	+0·02
„	P.M.	156·29	−0·7	1·94	+0·01
Apr. 19	C.D.	156·43	−0·5	1·92	−0·01
„	P.M.	157·53	+0·6	1·87	−0·06
May 3	C.D.	152·95	−4·0	1·93	0·00
„	P.M.	154·68	−2·3	1·98	+0·05

Ilford "Empress" plates were used for the first three of these days, and a Hill-Norris' dry collodion "Gazelle" plate on May 3. For the "Empress" plates several exposures were given on each plate, varying from $\frac{1}{5}$s to 1s, and for the "Gazelle" plate from $\frac{1}{2}$s to 5s.

Name of Star.		R.A. 1900·0.	N.P.D. 1900·0.	Mags.	Position Angle.	Distance.	Epoch.	Number of Photos.	Number of Images
		h m	° ′		°	″			
β Persei	AB	3 2	49 26	... 13·5	155·29	58·24	1899·820	3	3
	AC	...	...	... 14·2	145·58	67·47	1899·820	3	3
	AD	...	...	3 11·0	192·65	81·73	1899·820	3	3
	AE	...	...	... 12·5	185·39	85·69	1899·820	3	3
	BC	...	...	13·5 14·2	101·16	14·05	1899·820	3	3
	DE	...	...	11·0 12·5	119·48	11·26	1899·820	3	3
Aldebaran	AB	4 30	73 42	1·0 14·2	109·80	31·73	1899·182	4	4
	AC	...	...	1·0 10·6	...	117·89	1899·182	4	4
	AC	...	...	...	34·36	...	1899·199	2	2
	AB	...	...	1·0 14·2	109·74	31·57	1900·019	4	4
	AC	...	...	1·0 10·6	34·09	118·27	1900·019	4	4
Castor ...	...	7 28	57 53	2·7 3·7	226·32	6·15	1899·219	1	5
Pollux ...	...	7 39	61 44	1·1 14·3	280·05	29·65	1900·076	2	2
α Cancri...	...	8 53	77 45	4·3 11·2	147·61	11·40	1899·197	1	3
ξ Ursæ Maj.	...	11 13	57 54	4·0 4·9	156·96	1·93	1899·298	4	13
γ Virginis	...	12 36	90 52	3·0 3·0	149·59	5·73	1899·319	4	16
ζ Ursæ Maj.	...	13 20	34 33	2·6 4·2	149·69	14·42	1899·290	1	5
ε Boötis...	...	14 38	62 29	3·0 6·3	326·71	2·60	1899·285	3	11
σ Coronæ Bor.	...	16 11	55 53	5·0 6·1	212·97	4·38	1899·531	1	12
α Herculis	AB	17 10	75 30	3·0 6·1	114·50	4·75	1899·468	2	7
	AC	...	...	3·0 15	334·85	24·07	1899·523	1	1

Name of Star.		R.A. 1900·0.	N.P.D. 1900·0.	Mags.	Position Angle.	Distance.	Epoch.	Number of Photos.	Number of Images.
		h m	° ′		°	″			
τ Ophiuchi	...	17 58	98 11	5·0 6·0	256·42	1·71	1899·567	1	8
OΣ 358 ...	...	18 31	73 6	6·5 7·0	194·48	1·73	1899·567	1	6
α Lyræ ...	...	18 33	51 19	1 14	285·07	54·36	1899·580	1	1
ε Lyræ ...	...	18 41	50 30	5·0 6·5	11·64	3·08	1899·580	1	7
5 Lyræ ...	...	...	...	5·1 5·2	127·57	2·35	1899·580	1	6
β 650	AB	19 27	83 43	8·1 11·6	148·56	6·80	1899·635	1	1
	AD	...	...	8·1 10·0	254·38	27·04	1899·635	1	1
	AC	...	...	8·1 13·0	327·52	11·43	1899·635	1	1
β 438	AB	19 28	53 32	8·0 12·7	31·25	4·63	1899·775	1	1
	AC	...	...	8·0 8·2	247·89	46·80	1899·705	2	4
	AD	...	...	8·0 8·2	246·23	52·63	1899·705	2	4
	AE	...	...	8·0 12·8	237·63	21·18	1899·705	2	2
	CD	...	...	8·2 8·2	53·20	6·03	1899·705	2	4
β 659 ...	...	19 50	83 8	6·6 12·5	313·67	12·96	1899·774	2	2
α Delphini	AB	20 35	74 26	4·0 13·5	223·59	29·19	1899·765	2	2
	AC	...	...	4·0 11·1	279·44	43·95	1899·673	3	3
	AD	...	...	4·0 11·5	151·78	47·65	1899·673	3	3
	AE	...	...	4·0 12·7	307·67	51·59	1899·650	2	2
	AF	...	...	4·0 11·0	115·15	79·24	1899·673	3	3
T Cygni	AB	20 43	56 0	5·6 12·2	121·36	10·31	1899·773	2	2
	AC	...	...	5·6 13·3	196·24	12·66	1899·773	2	2
61 Cygni	...	21 2	51 46	5·1 6·0	125·36	21 92	1899·798	4	15
β 449	AB	21 35	48 45	7·1 12·7	13·09	6·20	1899·646	3	3
	AC	...	...	7·1 11·0	171·91	13·91	1899·646	3	3
	AD	...	...	7·1 12·1	247·10	17·43	1899·646	3	3
	AE	...	...	7·1 7·2	44·82	29·03	1899·646	3	3
κ Pegasi	AC	21 40	64 51	3·9 10·8	300·42	12·86	1899·801	5	6
19 Cephei	...	22 2	28 13	5·7 11·5	93·20	20·09	1899·775	2	2
β 698 ...	...	22 7	83 37	6·8 11·0	337·09	10·58	1899·797	3	3
β 377	AB	22 11	35 51	8·0 10·6	66·07	61·81	1899·792	2	3
	AC	...	...	8·0 11·3	60·50	58 30	1899·792	2	3
	AD	...	...	8·0 13·0	264·23	34·88	1899·792	2	3
	AE	...	...	8·0 14·0	260·94	40·09	1899·789	1	1
	AF	...	...	8·0 13·0	112·65	33·54	1899·792	2	2
	BC	...	...	10·6 11·3	303·49	7·07	1899·792	2	3
	DE	...	...	13·0 14·0	241·49	6·07	1899·789	1	1

Royal Observatory, Greenwich:
1900 *April* 10.

Cometary Observations at the Liverpool Observatory. By W. E. Plummer.

Comet 1898 *X* (*Brooks, October* 20).

Greenwich Mean Time of Observation. 1899.	h m s	✐ − ✱ R.A. m s	No. of Comparisons.	Apparent R.A. of ✐. h m s	✐ − ✱ Declination. ′ ″	No. of Comparisons.	Apparent Declination of ✐. ° ′ ″	Log. Factor of Parallax in α.	in δ.	Star of Comparison.
Oct. 24	10 2 14·5	+5 59·67	10	15 55 59·38	−7 23·2	5	+50 36 9·6	+9·6394	−0·8421	1
	10 2 14·5	−3 6·90	10	15 55 59·51	+3 10·2	5	+50 36 8·1	+9·6394	−0·8421	2
30	7 7 22·4	−1 39·18	Ret.	17 0 42·06	+5 52·1	Ret.	+33 26 43·4	+9·6058	−0·7041	3
31	6 58 4·7	−1 14·61	10	17 7 45·22	+2 33·3	6	+30 44 2·1	+9·5840	−0·7122	4
Nov. 1	7 3 27·0	−1 15·16	10	17 14 8·30	−1 53·0	5	+28 6 3·2	+9·5761	−0·7335	5
1	7 3 27·0	−1 30·38	10	17 14 8·32	−5 19·6	5	+28 6 4·9	+9·5761	−0·7335	6
3	6 50 50·1	+ 2·88	Ret.	17 24 56·14	−4 54·5	Ret.	+23 13 54·5	+9·5473	−0·7514	7
6	6 56 34·3	− 40·82	12	17 37 38·66	−2 7·7	6	+16 46 29·6	+9·5332	−0·7912	8
7	6 8 40·5	+ 0·62	Ret.	17 41 0·78	−1 23·4	Ret.	+14 55 4·5	+9·4817	−0·7816	9
10	6 4 33·6	+ 39·47	10	17 49 46·21	−3 54·6	5	+ 9 44 33·6	+9·4731	−0·8087	10
10	6 4 33·6	−1 26·11	8	17 49 46·13	−1 46·0	5	+ 9 44 34·0	+9·4731	−0·8087	11

October 24.—The comet is a fairly bright object, with well-defined centre, which makes the observation easy.
October 30.—The comet seen through some haze with difficulty. The observation is somewhat uncertain.
November 7.—The comet is bright, but very ill-defined, and the observations lack coherence.